SECTION 4
TRAFFIC COATING USER COSTS

The economic analysis up to this point has focused
entirely on the primary impacts of the regulation, those borne
directly by producers in the architectural coatings industry
in the form of higher costs and indirectly by the consumers of
architectural products in the form of higher prices. The
driving force of those impacts is the requirement that
noncompliant products must either be reformulated to a
compliant VOC level, be subject to a fee on the excess VOCs
over the allowable level, or be withdrawn from the market.
However, in this section a type of *secondary* impact is
considered, one that is caused by the costs that users of a
newly compliant product must incur to purchase the special
equipment necessary to apply the compliant coating. The
analysis focuses exclusively on users of traffic marking
paints, primarily consisting of government entities such as
state transportation departments, for whom the costs of
equipment switching are thought to be potentially significant.
While it is possible that other significant secondary impacts
exist, the extent and size of those is unknown and therefore
not quantified in this report.

One complicating factor in estimating the cost of the
regulation for traffic coating users is the fact that
equipment replacement is a normal activity that would occur in
the absence of the regulation. Therefore, rather than viewing
the regulation as creating equipment replacement

responsibilities, it is more correct to say that a different (accelerated) time pattern of equipment replacement is required. This section presents the issue analytically and then computes the incremental costs imposed on the population of traffic coating users.

According to the data collected for this study, the service life of traffic marking coating trucks (stripers) is typically 20 years.[64] If the average truck is midway through its replacement cycle, it will be replaced 10 years in the future in the absence of the regulation. However, to apply waterborne coatings that are likely to result from the regulation, users will be required to change the application equipment. The application equipment can be changed by either purchasing new trucks with the proper equipment or retrofitting the current trucks with special equipment to handle the new coatings. The incremental costs of each are discussed in turn below.

4.1 TRUCK REPLACEMENT COST METHOD

In an example of truck replacement, new trucks will be purchased now rather than 10 years in the future, and this acceleration imposes costs on the government entity. To estimate the costs of this replacement acceleration process, the cost of a large replacement truck ($250,000) is used to compute the net present value (NPV) today (at a 7 percent real interest rate) of replacing the truck 10 years in the future:

$$NPV(-10) = \$250,000/1.07^{10} = \$127,087. \qquad (4.1)$$

Instead, the government entity is now required to replace the truck today at a cost of

$$NPV(0) = \$250,000. \qquad (4.2)$$

Assuming no salvage value for the current truck, the NPV cost of accelerating the next replacement is then the difference in these values.

$$\text{Initial net effect} = NPV(0) - NPV(-10) = \$122,913. \quad (4.3)$$

Thus, if the regulation just accelerates the next replacement, the one-time cost of that acceleration is approximately $123,000.

However, accelerating the replacement of the current equipment by 10 years also accelerates the next round of equipment replacements (from 30 years hence to 20 years hence) and so on. Thus, the effects reverberate into all future replacement decisions. This point is demonstrated graphically by the alternative time lines of expenditures in Figure 4-1. The regulation effectively moves up the entire replacement schedule by 10 years. The computation must therefore be expanded to measure the present value of the current and all future adjustments. To start, the present value of an initial $250,000 cash expenditure repeated every 20 years thereafter is computed:

$$V(0) = \$250,000 + \$250,000*(1/((1.07)^{20} - 1))$$
$$= \$337,118. \quad (4.4)$$

Without the regulation, this stream of costs would be deferred 10 years into the future. Evaluating this in present value terms gives

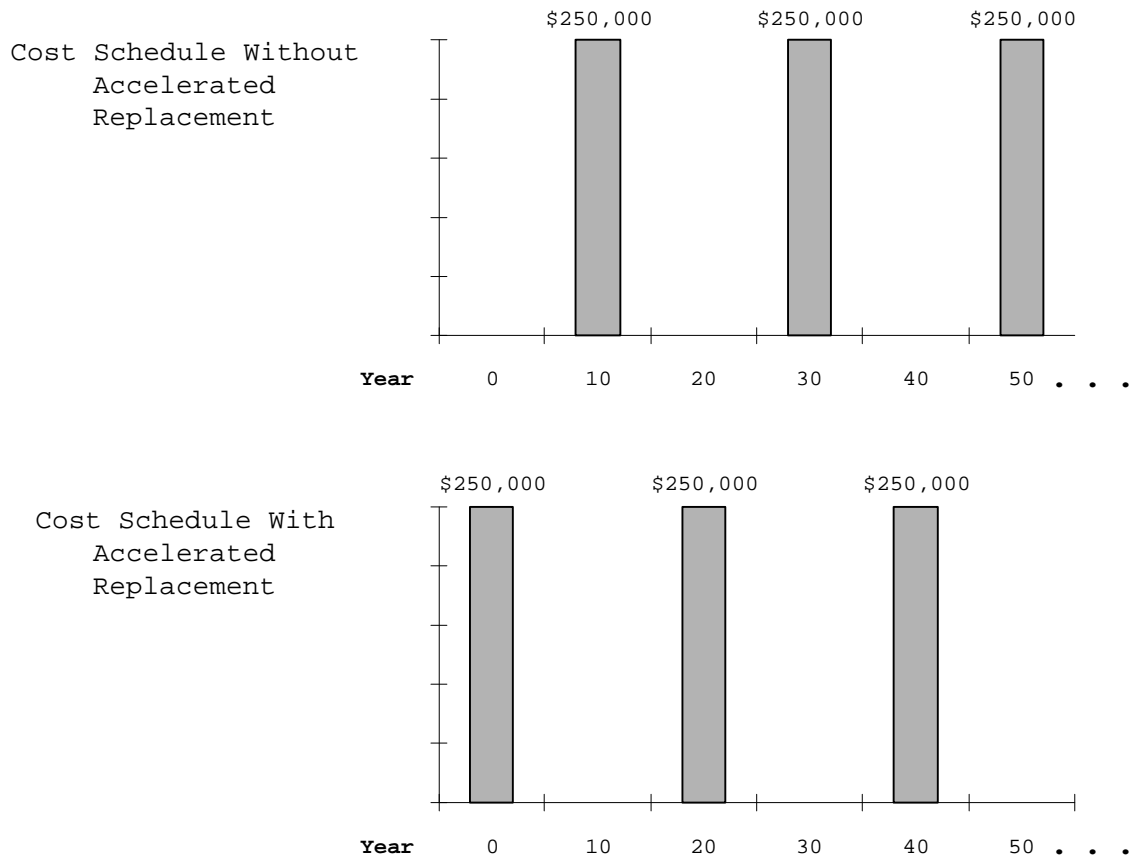$$V(-10) = V(0)/1.07^{10} = \$171,373. \quad (4.5)$$

Figure 4-1. Cost schedules with and without accelerated replacement.

Thus, the difference in present value between the two replacement cost streams is the total cost of accelerating this and all future purchases:

$$\text{Total net effect} = V(0) - V(-10) = \$165{,}744. \qquad (4.6)$$

This can be viewed as a *one-time cost* of the regulation for the component of a government entity's traffic coating striper fleet that is 10 years old. This explicitly accounts for the present value of the regulation's effect on all future replacement costs.

4.2 EQUIPMENT RETROFIT METHOD

An alternative to early replacement of a traffic coating truck is to retrofit the current truck with equipment that can use the compliant coating. This allows the government entity to continue to use the current truck until the end of its service life, at which time it will be replaced with a new truck that is able to apply compliant coatings. Assuming that the replacement schedule for the truck is unaffected by the retrofit, then none of the costs of accelerated replacement just discussed will apply. This is demonstrated in Figure 4-2. As with the example in Figure 4-1, replacement costs without the regulation would occur 10, 30, 50, etc. years hence. Under the retrofit example, the government entity incurs the retrofit costs now (Year 0) but still maintains the same future replacement cost schedule. Therefore, assuming no salvage value for the retrofit equipment, the one-time cost of the regulation is simply the cost of purchasing the retrofit equipment in Year 0. The present value of all future costs is identical with and without the regulation.

4.3 NATIONAL INCREMENTAL COST CALCULATION

The cost of the regulation for traffic coating users is computed separately for the estimated current fleet of medium stripers (Table 4-1) and large stripers (Table 4-2). Costs are aggregated across both types and summarized in Table 4-3.
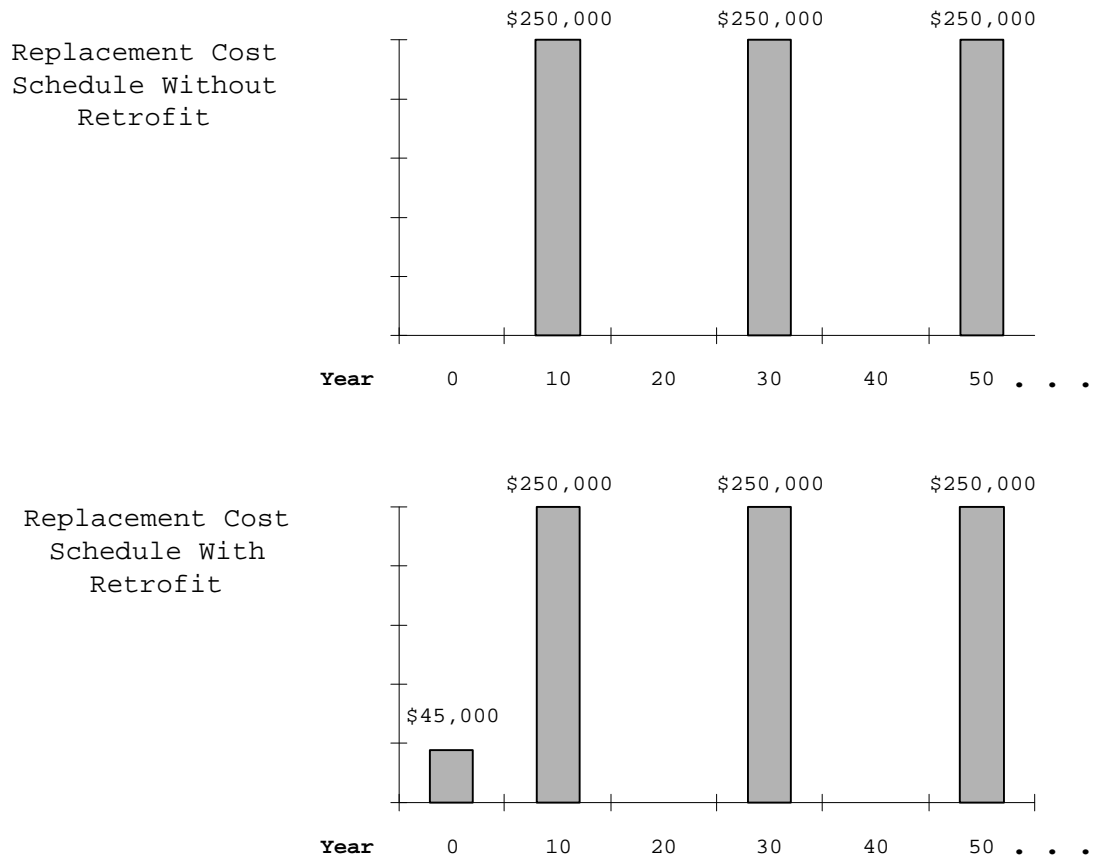
Figure 4-2. Replacement cost schedules with and without equipment retrofit.

     Data on the vintage of the national fleets of medium and large stripers are provided in the traffic coating analysis report by ERG.[65] The government entities facing the decision to replace trucks now or to retrofit each vintage striper in the fleet are assumed to select the option that minimizes the present value of costs. When the PV of a new truck vs. retrofit is calculated, it appears that it would cost less for government entities to retrofit medium trucks that are under 15 years old than to purchase new trucks. As a result, all medium stripers currently older than 15 years (i.e., will be replaced within 5 years) are projected to be scrapped (at no

TABLE 4-1. NATIONAL INCREMENTAL COST OF TRAFFIC COATING EQUIPMENT REPLACEMENT AND RETROFITS—MEDIUM STRIPERS ($1996)

Assumptions

Baseline year equipment vintage	1999
Replacement cost	$100,000
T = service life	20
PV of replacement cost every 20 years	$134,847 computed
Retrofit cost	$35,000
Retrofit cutoff age	15
i = discount rate	0.07
Salvage value	0

Replacement scheme

      **** This is the present value (PV) (Year 0) of accelerating the replacement schedule.

Age	Scheduled Replace- ment Year	PV Replacement Cost Without Regulation	PV Replacement Cost With Regulation	PV Incremental Cost	Number of Replace- ments	PV Total Replace- ment	Annualized Cost
20	0	134,847	134,847	0	150	0	0
19	1	126,025	134,847	8,822	150	1,323,265	92,629
18	2	117,781	134,847	17,066	150	2,559,962	179,197
17	3	110,075	134,847	24,772	150	3,715,753	260,103
16	4	102,874	134,847	31,973	150	4,795,932	335,715
						12,394,912	867,644

(continued)

Retrofit scheme

Assume that replacement schedule is unaffected by retrofit.
Therefore service life of retrofit is equal to the remaining life of the
current equipment.

Retrofit	Scheduled Replacement = Useful Life of Retrofit	PV per Retrofit	Number of Retrofits	PV of Retrofits	Annualized Cost
15	5	35,000	150	5,250,000	367,500
14	6	35,000	90	3,150,000	220,500
13	7	35,000	90	3,150,000	220,500
12	8	35,000	90	3,150,000	220,500
11	9	35,000	90	3,150,000	220,500
10	10	35,000	90	3,150,000	220,500
9	11	35,000	90	3,150,000	220,500
8	12	35,000	90	3,150,000	220,500
7	13	35,000	90	3,150,000	220,500
6	14	35,000	0	0	0
5	15	35,000	0	0	0
4	16	35,000	0	0	0
3	17	35,000	0	0	0
2	18	35,000	0	0	0
1	19	35,000	0	0	0
				30,450,000	2,131,500
			Sum	42,844,912	2,999,144

[a] The PV of the replacement scheme is the PV cost of an accelerated replacement
 schedule. This is a one-time event; thus, we annualize this value by
 multiplying it by the discount rate. All service life issues are implicitly
 captured in the PV calculation.

[b] The PV of each retrofit is $35,000. This is also a one-time cost (i.e., it
 does not need to be repeated). Therefore, it is also annualized by multiplying
 by the discount rate.

Note: The replacement of retrofitted vehicles will follow the same schedule as
       without regulation, so there is no replacement acceleration taking place.

TABLE 4-2. NATIONAL INCREMENTAL COST OF TRAFFIC COATING
EQUIPMENT REPLACEMENT AND RETROFITS—LARGE STRIPERS ($1996)

Assumptions

Baseline year equipment vintage	1999
Replacement cost	$250,000
T = service life	20
PV of replacement cost every 20 years	$337,118 computed
Retrofit cost	$45,000
Retrofit cutoff age	17
i = discount rate	0.07
Salvage value	0

Replacement scheme

    **** This is the PV (Year 0) of accelerating the replacement schedule.

Age	Scheduled Replace- ment Year	PV Replacement Cost Without Regulation	PV Replacement Cost With Regulation	PV Incremental Cost	Number of Replace- ments	PV Total Replace- ment	Annualized Cost
20	0	337,118	337,118	0	25	0	0
19	1	315,063	337,118	22,054	25	551,361	38,595
18	2	294,452	337,118	42,666	25	1,066,651	74,666
						1,618,011	113,261

TABLE 4-2.   NATIONAL INCREMENTAL COST OF TRAFFIC COATING
EQUIPMENT REPLACEMENT AND RETROFITS—LARGE STRIPERS
($1996)(CONTINUED)

Retrofit scheme
        Assume that the replacement schedule is unaffected by retrofit.

Retrofit	Scheduled Replacement = Useful Life of Retrofit	PV per Retrofit	Number of Retrofits	PV of Retrofits	Annualized Cost
17	3	45,000	25	1,125,000	78,750
16	4	45,000	25	1,125,000	78,750
15	5	45,000	25	1,125,000	78,750
14	6	45,000	15	675,000	47,250
13	7	45,000	15	675,000	47,250
12	8	45,000	15	675,000	47,250
11	9	45,000	15	675,000	47,250
10	10	45,000	15	675,000	47,250
9	11	45,000	15	675,000	47,250
8	12	45,000	15	675,000	47,250
7	13	45,000	15	675,000	47,250
6	14	45,000	0	0	0
5	15	45,000	0	0	0
4	16	45,000	0	0	0
3	17	45,000	0	0	0
2	18	45,000	0	0	0
1	19	45,000	0	0	0
				8,775,000	614,250
			Sum	10,393,011	727,511

[a] The PV of the replacement scheme is the PV cost of an accelerated replacement
   schedule. This is a one-time event; thus, we annualize this value by
   multiplying it by the discount rate. All service life issues are implicitly
   captured in the PV calculation.

[b] The PV of each retrofit is $45,000. This is also a one-time cost (i.e., it
   does not need to be repeated). Therefore, it is also annualized by multiplying
   by the discount rate.

Note: The replacement of retrofitted vehicles will follow the same schedule as
        without regulation, so there is no replacement acceleration taking place.

TABLE 4-3. NATIONAL INCREMENTAL COST SUMMARY FOR TRAFFIC
COATING EQUIPMENT ($1996)

Striper Type	PV of Cost	Annualized Cost
Medium (see Table 4-1)	$42,844,912	$2,999,144
Large (see Table 4-2)	$10,393,011	$727,511
Total	$53,237,923	$3,726,655

salvage value) and replaced with new trucks, while all medium
stripers under 15 years old are projected to retrofit the
current vehicles. The corresponding age threshold for this
decision is 17 years for large stripers.

Present value costs are computed for each vintage year,
dependent on the replacement/retrofit decision, and then are
multiplied by the number of stripers of that vintage in the
fleet. This calculation is then summed across all vintage
years to estimate the present value of national costs. As
Table 4-3 indicates, the present value of total national costs
is estimated at $53.2 million – $42.8 million for medium
stripers and $10.4 million for large stripers.

This present value figure is the one-time cost of the
regulation for the government entities faced with equipment
replacement. For comparability with the other estimates in
this analysis, this figure must be expressed in annualized
terms. Because the acceleration (and its costs) are a one-
time event not to be repeated in the future, the appropriate
form of annualization is to compute the corresponding
perpetual annuity value—the amount, if paid out in annual
installments into perpetuity, that would have a present value
equal to the one-time cost estimate. This number is computed
simply by multiplying the one-time cost estimate by the
discount rate of 7 percent

Annualized cost = ($53.2 million) • .07 = $3.7 million

This is the conceptually correct figure for the annualized costs incurred by government entities to switch equipment for traffic marking coating application. This annual estimate is used to compute cost-effectiveness measures in the next section.

64. Eastern Research Group. "Traffic Coating Analysis."
    Prepared for the U.S. Environmental Protection Agency,
    Office of Air Quality Planning and Standards.
    Morrisville, NC: Eastern Research Group. 1998.

65. Ref. 64.